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Inequitable Dispersion: Mapping the Distribution of Highly Qualified Teachers in St. Louis Metropolitan Elementary Schools

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Abstract: The No Child Left Behind (NCLB) Act of 2001 required all schools, including those located in historically disadvantaged areas, to employ highly qualified teachers. Schools in areas with higher levels of poverty and students of color have historically employed a higher percentage of less qualified teachers (Clotfelter, Ladd, & Vidgor, 2005, 2006; Hill & Lubienski, 2007; Lankford, Loeb, & Wyckoff, 2002). This study examines the distribution, location, and exceptions to highly qualified teachers in St. Louis metropolitan elementary schools. Using Geographic Information Systems (GIS), this study demonstrates how the distribution of highly qualified teachers remains relevant to urban education policy discussions.

Keywords: elementary schools; highly qualified teachers; No Child Left Behind; poverty; race; urban schools

Distribución desigual: Mapeo de la distribución de maestros altamente calificados en escuelas primarias públicas metropolitanas de St. Louis

Resumen: la ley NCLB de 2001 requiere que todas las escuelas, incluidas las situadas en las zonas históricamente desfavorecidas empleen a maestros altamente calificados. Las

escuelas en las zonas con mayores niveles de pobreza y estudiantes de color han empleado históricamente un mayor porcentaje de maestros menos calificados (Clotfelter, Ladd, y Vidgor, 2005, 2006; Hill & Lubienski, 2007; Lankford, Loeb, y Wyckoff, 2002). Este estudio examina la distribución, la ubicación y las excepciones a la normativa a los maestros altamente calificados en las escuelas primarias metropolitanas de San Luis. Usando Sistemas de Información Geográfica (GIS), este estudio demuestra cómo la distribución de profesores altamente cualificados sigue siendo relevante para los debates sobre políticas de educación urbana.

Palabras clave: escuelas primarias; maestros altamente calificados; NCLB; raza; escuelas urbanas.

Distribuição desigual : o mapeamento da distribuição de professores altamente qualificados nas escolas primárias públicas na região metropolitana de St. Louis

Resumo: A lei NCLB de de 2001 exige que todas as escolas , incluindo aquelas localizados em áreas historicamente desfavorecidas empreguem professores altamente qualificados. Escolas em áreas com níveis mais elevados de pobreza e estudantes de cor, historicamente, empregaram uma percentagem mais elevada de professores menos qualificados (Clotfelter , Ladd e Vidgor , 2005, 2006, Hill & Lubienski de 2007 , Lankford , Loeb e Wyckoff , 2002). Este estudo analisa a distribuição, localização e exceções às regras de professores altamente qualificados nas escolas primárias na região metropolitana de St. Louis. Utilizando Sistemas de Informação Geográfica (GIS) , este estudo mostra como a distribuição de professores altamente qualificados ainda é relevante para a discussão das políticas de educação urbana.

Palavras-chave: escolas elementares ; professores altamente qualificados ; NCLB; pobreza; raça; escolas urbanas.

Introduction

The accountability movement resulting from the No Child Left Behind (NCLB) Act requires that all schools employ “highly qualified” teachers. The act specifically targets “disadvantaged”¹ students—including students of color and students located in high-poverty schools (No Child Left Behind [NCLB], 2002). Several studies have found that students with lower socioeconomic status (SES) backgrounds have a higher percentage of less qualified teachers across districts and within their own schools (Clotfelter, Ladd, & Vidgor, 2006; Hill & Lubienski, 2007; Lankford, Loeb, & Wyckoff, 2002). NCLB directly calls for states “to ensure that poor and minority children are not taught at higher rates than other children by inexperienced, unqualified, or out-of-field teachers” (NCLB, 2002). NCLB has defined what it means for a classroom teacher to be highly qualified. The requirements for a new elementary teacher to be considered highly qualified include: full state certification as a teacher; a minimum of a bachelor’s degree obtained from an accredited institution of higher education; and subject knowledge and teaching skills in reading, writing, mathematics, and other areas of the basic elementary school curriculum as demonstrated by passing a rigorous state test (NCLB, 2002). States were required to have policies in place to ensure that highly qualified teachers taught 100% of courses by the 2005-2006 school year.

Segregated metropolitan areas like St. Louis had the potential to be deeply impacted by such legislation. Within metropolitan St. Louis, poverty and students of color are highly concentrated within the city and northern suburbs (Gordon, 2008). Given that students with lower SES backgrounds often have higher percentages of teachers with lower qualifications, students in schools

¹ Per the NCLB definition, the term “disadvantaged” includes, “low-achieving children in our Nation’s highest poverty schools, limited English proficient children, migratory children, children with disabilities,

in low SES areas have the most to gain from the requirement that their teachers be highly qualified. Unfortunately, these students are also the ones most vulnerable to exceptions made to this requirement (Phillips, 2010).

More recently, states have begun to request ESEA flexibility waivers that allow them to waive some of the requirements of NCLB, including those regarding highly qualified teachers. Missouri is one of 42 states approved for such waivers (U.S. Department of Education, 2012). As part of the waiver, the state of Missouri has created a new teacher evaluation system, which allows school districts to bypass the 100% highly qualified teacher mandate (Missouri Department of Elementary and Secondary Education [MODESE], 2012a). School districts in Missouri have the option to follow the Missouri Educator Evaluation System (MEES), or create one for their district that is similar. The new system, which focuses on teacher effectiveness, is comprised of the following seven principles:

measuring performance based on research-based and proven practices; using differentiated levels of performance; highlighting the probationary period as a significant time of intensive support; including measures of growth in student learning as evidence of performance; providing regular, timely and meaningful feedback on performance; including standardized and ongoing training for evaluators; and using evaluation results to inform employment decisions and policy (MODESE, 2012a, p. 1).

The definition of “teacher effectiveness” is not clearly defined, but MODESE (2012a) insinuates that it will be evident through improved student performance. The MEES was recently field-tested, and will be fully implemented in the 2014–2015 school year. Consequently, the implications of utilizing this new evaluation system are unclear at this point in time. Under NCLB, the percentage of teachers that were highly qualified in schools was publically reported; it is not clear if the results of the MEES will be made public. Further, the focus of the MEES is on monitoring the overall effectiveness of teachers despite the fact that researchers still “cannot identify specific teacher characteristics that compose teacher effectiveness” (Konstantopolous, 2011, p. 1545). Regardless, it is still important to understand the qualifications that teachers are bringing with them to their classroom, as those qualifications are often assumed to play a role in teacher effectiveness. Konstantopolous (2011) found that kindergarten students taught by the most effective teachers for three consecutive years had significant gains in reading achievement. Therefore, many researchers, policy makers, and school administrators still have a vested interest in identifying the characteristics of an effective teacher.

It is important to note that both teacher and student assignment within schools and school districts is not random, and may bias the association between student achievement and subsequent teacher effectiveness (Clotfelter et al., 2006; Konstantopolous, 2011). Further, the collective quality of teachers within a school and within a district have been shown to impact reading and math achievement in elementary schools (Heck, 2007). Therefore, it is important to examine the distribution of the qualifications that teachers are bringing with them to their classroom and schools.

Results from studies examining highly qualified teacher compliance are inconclusive, particularly when factors beyond basic definitions of teacher qualifications are included (Boyd, Lankford, Loeb, Rockoff, & Wyckoff, 2008; Choi, 2010; DeAngelis, White, & Presley, 2010). For example, Boyd et al. (2008) found smaller discrepancies of highly qualified teachers between high- and low-poverty schools in New York City in 2005 than they did in 2000. Yet, Choi (2010) argued that the NCLB’s definition of a highly qualified teacher is too simple, and continues to mask uneven teacher quality distribution within a district. Moreover, most studies investigate teacher qualifications at the secondary level; very little research has focused on the distribution of highly qualified teachers

within elementary schools (Choi, 2010; Croninger, Rice, Rathbun, & Nishio, 2007; Phillips, 2010; Rice, 2003). Therefore, understanding the distribution of teacher quality, particularly at the elementary level, is critical for school reform.

The purpose of this paper is to describe the geographic distribution of highly qualified elementary teachers within the St. Louis metropolitan area. This study concentrates on the geographic location of highly qualified teachers in St. Louis metropolitan elementary schools, as the pattern of urban decay and suburban sprawl in St. Louis is representative of a broader national trend in metropolitan areas (Orfield, 2002). Further, the geographic fragmentation of the St. Louis region is reflective of the political and educational structures within the metropolitan area (Baybeck & Jones, 2004). Therefore, this analysis uses geographic information system (GIS) technology to examine the nature of teacher distribution patterns by student race and student SES within an entire region. Using GIS allows researchers to closely analyze how relationships between variables can vary across geographic area (Hogrebe & Tate, 2012). Through geospatial mapping, this study will also investigate the distribution of various teacher quality-related factors beyond NCLB requirements such as type of certification, and possession of a master's degree. Last, exceptions to the definition of highly qualified in the St. Louis metropolitan area will be explored. Overall, the application of GIS in this study aims to demonstrate how the geographic location of teachers continues to be relevant within education policy.

Background Literature

Importance of Teacher Quality in Elementary Schools

NCLB focuses on teacher qualifications for two main reasons: to create a higher-quality teaching force and to ensure equitable learning opportunities for all students (Phillips, 2010). In addition, NCLB requirements set a minimum standard for all teachers, while still allowing state agencies the flexibility to determine a high-quality teacher through a state-specific elementary skills test. Yet, in spite of the flexibility offered to states, compliance is still problematic in difficult-to-staff schools (Boyd et al., 2008).

There are several reasons to examine teacher quality within elementary schools. First, unlike students in higher grades, elementary students usually spend the majority of their day with one classroom teacher. Phillips (2010) argued that since elementary students have longer exposure to their classroom teacher than secondary students, "policy-relevant teacher characteristics may be more important in elementary schools" (p. 417). Moreover, since an elementary teacher is typically responsible for teaching all content areas, having a teacher who is highly qualified seeks to ensure that students are receiving their content instruction from someone who is knowledgeable.

Another important reason to examine elementary schools is because young children are cognitively unique. A younger student's cognitive growth is more rapid than that of an older student (Burkam, Ready, Lee, & LoGerfo, 2004). Since elementary students learn foundational skills that last throughout their lives, the teacher these younger students have can be vitally important to their development. The exposure to these skills that a child receives is important, as it may have direct implications for later reading ability. Research has shown that children who cannot read at a level of proficiency by the end of third grade are more likely to drop out of school (Fiester, 2013; Hernandez, 2011). The implications of these findings are exacerbated for children living in poverty. Socioeconomic status (SES) has been shown to significantly impact the cognitive growth of young students (Burkham et al., 2004; Noble, Norman, & Farah, 2005). While many other social factors complicate this relationship, Burkham et al. (2004) argued that learning differences among students from lower and higher SES backgrounds increase during the early elementary years, particularly in

math and reading. Research by Noble et al. (2005) reflects these findings. They found that lower SES negatively impacts language and executive functioning systems in kindergarten children. Considering the rapid cognitive growth of young students, children from lower SES backgrounds should have a highly qualified teacher from the beginning of their school experience.

Since elementary students are typically placed within self-contained settings and have special cognitive needs, Phillips (2010) argued that early learners are particularly sensitive to teacher-quality indicators. However, the effect of teacher quality upon achievement is often studied in secondary, instead of elementary grade levels. While Darling-Hammond, Berry, and Thoreson (2001) found that educators with more training² produce better academic results than do those with less training, these results are only consistent among secondary students. Generally, educators and policymakers agree that teacher quality matters; but in elementary schools, the relationship between teacher qualifications and achievement remains unclear (Croninger et al., 2007; Darling-Hammond, Berry, & Thoreson, 2001; Guarino, Hamilton, Lockwood, Rathbun, & Hausken, 2006; Rice, 2003).

Guarino et al.'s (2006) research on the relationship between teacher qualifications³, instructional practices, and kindergarten math and reading achievement provides an example of the ambiguous nature of results. They found that while there was no direct relationship between the self-reported qualifications of the teachers and the achievement scores of the kindergarten students, the amount of methods coursework the teachers had taken was positively related to various instructional practices associated with higher student achievement. Therefore, while the individual qualifications of a teacher (i.e. educational attainment) did not have a direct statistical relationship with student achievement, the process of becoming certified, and subsequent coursework, was associated with practices leading to higher student achievement.

While the meta-analysis conducted by Rice (2003) examined the impact of teacher characteristics on teacher effectiveness at all grade levels, she highlighted the results found for elementary teachers. Her analysis exemplifies the complex relationship between teacher characteristics⁴ and teacher effectiveness in elementary schools. For example, she found that the relationship between teacher experience and student achievement is positive within the first few years of teaching, and again with very experienced veteran teachers. However, there is a negative relationship between teachers with advanced degrees in mathematics and mathematics achievement in elementary schools when student background and other teacher characteristics are controlled. Language arts (English) achievement was unaffected. Last, English and mathematics subject-specific certification had no effect on student achievement in these subjects. However, it is important to note that the empirical article Rice's review cites brought attention to the fact that only 6% of the teachers in their study had special certification and/or a subject-specific degree; therefore, the authors argued that these results should be analyzed with caution (Rowan, Correnti, & Miller, 2002). Thus, the relationship between advanced degrees and student achievement remains unclear.

² Darling-Hammond, Berry, and Thoreson (2001) use advanced degrees and traditional certification to define more training.

³ Guarino et al. (2006) examined the following teacher qualifications: type of certification (regular, alternatively credentialed, or noncertified), number of methods coursework in teaching reading and mathematics, educational attainment, and years of teaching experience (full time or part-time).

⁴ Rice (2003) analyzes results from empirical studies that examined the impact of teacher experience, teacher preparation programs and degrees, teacher certification, teacher coursework and teacher test scores on student English and mathematics achievement.

A study by Croninger et al. (2007) supported the significance of teacher qualifications in student learning. Specifically, they examined the relationship between teacher qualifications⁵ and first-grade achievement in reading and mathematics. Their analysis indicated that both teacher coursework and an elementary education degree were associated with significant positive effects on reading achievement. Conversely, they found that other general measures of teacher qualification, such as certification status and advanced degrees, were not associated with student achievement. Their findings indicate that while it is important for elementary students to be taught by someone who has an elementary education degree, the status and level of the degree does not matter.

Overall, the literature shows that for specific environments, a teacher's level of experience, possession of an elementary education degree, and corresponding coursework may impact student achievement in elementary school. Although the literature does not clearly link possession of an advanced degree or certification status to improved teacher effectiveness, the geographic location of teachers holding proper certification and advanced degrees is still important to study. Not only are both commonly used measures, but the geographic location of teachers with advanced degrees may speak directly to the politics at play in segregated environments, such as St. Louis (Baybeck & Jones, 2004). Similarly, concentrations of certain kinds of certification status may be indicative of a difficulty to properly staff schools, and overall district climate (Heck, 2007).

Teacher Sorting in Elementary Schools

Despite lacking a universally agreed upon understanding of the specific qualifications that impact student learning, scholars agree that quality teachers matter (Choi, 2010; Konstantopoulos, 2011; Phillips, 2010; Rice, 2003). Therefore, it is important to examine how teachers and their various qualifications sort across geographic locations. Boyd et al. (2008) examined how discrepancies in teacher qualifications changed from 2000-2005 in New York City's elementary schools, and the effects the changes in discrepancies had upon student achievement⁶. They reviewed information regarding teacher experience, teacher demographics, selectivity of undergraduate institutions, certification pathway, SAT score, performance on the NYS Teacher Certification Exam, initial pathway to teaching, and completion of a college-recommended teacher preparation program for their analysis of teacher quality. They then analyzed the distribution of these teacher qualifications by comparing them to the location of poverty.⁷ Teacher qualifications for schools with the highest 10% and lowest 10% of students living in poverty were compared (designated as high-poverty and low-poverty, respectively). In 2000, high-poverty schools had higher levels of less qualified teachers than low-poverty schools.

This "distribution gap" was reanalyzed with 2005 data. Although discrepancies in placement of highly qualified teachers were still present in 2005, they were not as large as they had been in 2000. The authors note that most of the improvements in teacher qualifications were due to the qualifications of new hires, and that these improvements occurred before the implementation of the NCLB requirement. Many of the newly hired teachers in 2005 went through alternative certification programs such as Teaching Fellows and Teach for America. Boyd et al. found that 3% of these teachers were employed in high-poverty schools in 2000. By 2005, 43% of newly hired teachers in high-poverty schools came from these programs. The authors note that such teachers may also

⁵ Croninger et al. (2007) examined certification status (regular/alternative or other), elementary education degree, educational attainment, reading coursework, mathematics coursework, and years of experience.

⁶ Student achievement scores were obtained from the New York State exams in mathematics and English for grades 3 through 8.

⁷ High-poverty and low-poverty schools were measured by the proxy of percentage of students eligible for Free/Reduced Lunch (FRL).

inflate the teacher quality demographics, as many of these teachers came from stronger academic backgrounds than other new hires, while lacking other quality indicators.

Nevertheless, Boyd et al. (2008) found that the reduced distribution gap had an impact upon student achievement. Teachers with higher qualifications significantly raised math scores of 4th and 5th grade students. The gaps between the percentage of high-poverty and low-poverty students failing to meet proficient were reduced from 2000-2005. Using value-added modeling, Boyd et al. found that improvements in teacher qualifications in high-poverty schools increased student achievement by .03 standard deviations. While the authors add the caveat that the causal relationship between teacher qualifications and student achievement is not clear, they posit that it is important to hire and retain highly qualified teachers, as they are positively associated with student achievement. Therefore, it is important to continue to monitor the sorting of highly qualified teachers by SES.

Choi (2010) utilized GIS to examine the geographic distribution of teacher quality of another urban district by scrutinizing the Los Angeles Unified School District (LAUSD). In his study, NCLB was treated as a minimum requirement of teacher quality. He found that using a more rigorous definition to identify “highly qualified” teachers highlighted the location of less qualified teachers. Choi contended that a stronger definition is necessary, as the NCLB definition does not account for experience, nor does it account for provisionally certified teachers. He believed that by using a weaker (NCLB) definition, school districts were giving “the impression that access to teacher quality is not a concern across the district (when it really is), whereas a stronger definition indicates that a problem exists” (Choi, 2010, p. 392). He also asserted that looking at teacher quality geographically was necessary, as distribution of teacher quality across a local context (i.e. school district) can provide insight into opportunity structures within a region. He further argued that GIS is an ideal tool for capturing geospatial relationships and that the cumulative patterns of the relationship between general teacher quality factors and neighborhood context can be revealed through GIS.

To create his more rigorous definition of teacher quality, labeled TQ, Choi (2010) included teachers who had a full California teaching credential, had at least 5 years of experience, and had 42 semester units beyond their bachelor’s degree. He found that GIS clearly illustrated a pattern of geographic concentration of race, SES, and TQ. He also found that higher concentrations of Latino/African American students and FRL led to lower levels of TQ on staff. Or, put another way, teachers with lower TQ were concentrated in areas with higher levels of Latino/African American students and FRL. He concluded that there is a geographical element to the location of teacher quality, even within school districts, that cannot be ignored.

Overall, a substantial body of literature focuses on the relationships between teacher quality and student achievement. Yet, few studies have examined the sorting of teacher qualifications by geographic location both within a city and the surrounding metropolitan area. Although the Choi (2010) study examined NCLB compliance, as well as additional measures of teacher quality to reveal the difference in geographic distribution of elementary teacher qualifications, he only examined one large school district. This study expands on the Choi study to examine the distribution of teacher qualifications across the St. Louis metropolitan area. Additionally, the Choi study did not examine the location of exceptions made to the status of highly qualified teachers. Therefore, this study investigates the exceptions allowed by the largest local school district (SLPS) in order to more clearly understand teacher-sorting practices.

Methods

The data for this study was obtained from Missouri's Department of Elementary and Secondary Education (MODESE) website⁸. Variables for the study include the percentage of highly qualified teachers, percentage of teachers with a regular certificate, percentage of teachers with a master's degree, percentage of students receiving free/reduced lunch, and the percentage of students of color.

Variables

Highly qualified teachers. According to MODESE (2012b), the percentage of teachers in an elementary school that are highly qualified equals the percentage of classes taught by an individual who has the appropriate certification for his/her teaching assignment⁹. A highly qualified teacher is one that: has obtained full state certification as a teacher, or has passed the state's teacher licensing examination and holds a license to teach in the state, and does not have certification or licensure requirements waived on an emergency, temporary, or provisional basis; holds a minimum of a bachelor's degree; and has demonstrated subject-matter competency in each of the academic subjects in which the teacher teaches, in a manner determined by the state and in compliance with Sect. 9101(23) of ESEA. In Missouri, this is a passing score on the Praxis II test for that specific teaching area.

Instructors teaching on a provisional or temporary license are considered to be highly qualified during their first year teaching for that specific grade level and/or subject matter. However, in order to maintain his/her highly qualified status, the teacher must pass the Praxis II test during his/her first year of teaching for that grade level and/or subject matter. Additionally, teachers from programs such as Troops for Teachers and Teach for America are considered to be highly qualified during their first three years of teaching, despite only meeting the bachelor's degree requirement. Teachers from these programs have three years to obtain certification in the area in which they teach before they are no longer considered to be highly qualified. Lastly, provisional certificates are for educators who lack the education hours/coursework required for full certification, and who have not yet passed their required Praxis test. These certificates are issued at the request of the employing district as Temporary/Special Assignment certificates. Long-term and short-term substitute teachers do not fit this requirement.

Regular certificate. This variable refers to the percentage of teachers reported to have a regular certificate in the elementary school. These teachers have full state certification. Full state certification includes Initial, Life, Professional Class I & II, Continuous Professional, and first-year Provisional certificates. These certificates are grade and/or subject-area specific. This measure does not include Temporary, Special Assignment, Substitute, or expired certificates¹⁰. For this study, a teacher needed to have an elementary certificate. In order to have received a regular certificate, the teacher must have a minimum of a bachelor's degree, a grade point average of 2.5 on a 4.0 scale from their teacher education program, and have successfully passed the Praxis II test in elementary education.

⁸ Raw data at school and district level is available at: <https://mcids.dese.mo.gov/Pages/default.aspx>

⁹ This percentage includes all elementary classroom teachers (K-6), as well as reading, art, and music teachers. Teachers of Kindergarten must possess an early childhood certification in order to be considered highly qualified.

¹⁰ Teachers with these certificates are considered "improperly certified" (MODESE, 2012b). "Improper certification" is used throughout the paper to remain consistent with MODESE terminology.

Master's degree. The proportion of teachers with a master's degree is reported as the percentage of teachers within the building (including specialists such as reading specialists) who have obtained a master's degree or higher.

Free/reduced price lunch. Free/reduced price lunch (FRL) serves as a proxy for SES. It is reported as the percentage of students who are eligible to receive FRL within each school.

Percentage of students of color. Students of color is reported as the percentage of enrolled students within the school in the following groups: African-American, Hispanic, Asian, and American Indian.

Data

The sample for this study includes St. Louis Public School (SLPS) and St. Louis County school districts ($n = 24$) and their corresponding public elementary schools ($n = 199$) for school year 2008-2009. Schools that had data, but were closed at the end of the school year, are not included. Pearson correlation coefficients were calculated for all student and teacher variables to provide initial information about the relationships between types of students and the percentage of teacher variables in their schools. Then, the student variable data (percentage of students eligible for FRL and the percentage of students of color) were coded into quartiles. Schools that fell into the top two quartiles of percentage of students eligible for FRL, and schools that fell into the top two quartiles of percentage of students of color were coded as having "high" in terms of these demographics. Schools in the bottom two quartiles of these student variables were coded as "low." Then, independent two-sample t -tests were run for high and low levels of both student variables and all teacher variables in SPSS Statistics (IBM, 2012). The independent two-sample t -test was chosen because it was the most appropriate for comparing the difference between the means of two different populations. Additionally, a Levene's test was provided by SPSS. When a Levene's test produced a significant value, similar variance between groups could not be assumed. Therefore, t -scores for variances not assumed were examined when necessary. Last, effect sizes (Cohen's d) were calculated in order to more clearly examine the differences between high and low levels of student measures.

All of the data was coded and uploaded to the ArcMap program in ArcGIS10 (ESRI, 2010). The ArcMap program uses GIS software to create maps and analyze geospatial relationships. Maps were created to illustrate the spatial distribution of the variables, and density analysis was used to examine the clustering of the teacher variables. The density analysis was conducted by using the nearest neighbor tool, found in the statistics toolbox of ArcMap. The average nearest neighbor tool examines whether or not certain features of a variable show a statistically significant level of clustering (Allen, 2009). In order to determine statistical significance, this tool measures the average distance of the original data's nearest neighbor. It then creates a randomly dispersed hypothetical data set with the same number of features as the original data set. The hypothetical data set is then compared to the real data set to produce a ratio and corresponding z -score and p -value. The p -value denotes whether or not clustering of the teacher variable is random (high or low).

Lastly, to examine exceptions made to the highly qualified teacher requirement, 2011 documentation from Teach for America and the 2009 St. Louis School District Accountability Plan were used to estimate the number of provisionally certified and improperly certified classroom teachers within the St. Louis Public School District during 2009.

Results

Despite the stringent requirements of NCLB, results from this study are consistent with previous literature and indicate that less qualified teachers continue to be located in schools with higher

percentages of students of color and students with lower SES backgrounds. Correlations between the percentage of students eligible for receiving FRL, percentage of students of color, percentage of highly qualified teachers, percentage of teachers with master's degrees, and percentage of teachers with a regular certificate are listed in Table 1.

Table 1
Correlations Between Teacher and Student Variables

| | Percentage of Highly Qualified Teachers | Percentage of Teachers with a Masters Degree | Percentage of Regularly Certified Teachers |
|--|---|--|--|
| Percentage of Students Eligible for FRL | -.317*** | -.428*** | -.296*** |
| Percentage of Students of Color | -.386*** | -.471*** | -.364*** |

Note. *** $p < .001$ (2-tailed).

Correlations between teacher variables and percentage of students eligible for FRL and between teacher variables and percentage of students of color are nearly identical, although correlations between the teacher variables and the percentage of students of color are slightly stronger. All statistically significant correlations between teacher and student variables are negative, indicating that schools with higher levels of FRL and students of color have less qualified teachers.

Although many of the relationships between teacher and student variables identified through the above correlations were found to be similar to the results of the independent two-sample t -tests, the complexity of these relationships became more apparent. In 2009, the average percentage of courses taught by a highly qualified teacher was 98.62% in elementary schools with low levels of students eligible for FRL. Elementary schools with high levels of students eligible for FRL had an average of 92.78%. An independent sample t -test revealed the difference in percentage of highly qualified teachers in schools with low levels of students eligible for FRL ($M = 98.62$, $SD = 3.40$) and schools with high levels of students eligible for FRL ($M = 92.78$, $SD = 11.30$) is statistically significant, $t(117) = -4.947$, $p < .001$, 95% CI [-8.180, -3.503], $d = -.724$. This means that there are significantly fewer highly qualified teachers located in schools with higher levels of students living in poverty. Results from the independent two-sample t -tests are listed in Table 2 and Table 3. Further, Cohen's effect size ($d = -.724$) suggests a moderate to large difference in percentage of highly qualified teachers in schools with higher levels of students eligible for FRL.

Table 2

Results of Free/Reduced Lunch and Teacher Variables Independent Samples t-test

| Measure | Group | | | | | | 95% CI | | <i>t</i> | <i>df</i> | Cohen's <i>d</i> |
|------------------------------|----------|-----------|----------|----------|-----------|----------|-----------|-----------|----------|-----------|---------------------|
| | High FRL | | | Low FRL | | | <i>LL</i> | <i>UL</i> | | | |
| | <i>M</i> | <i>SD</i> | <i>n</i> | <i>M</i> | <i>SD</i> | <i>n</i> | | | | | |
| Highly Qualified Teachers | 92.78 | 11.30 | 100 | 98.62 | 3.40 | 99 | -8.18 | -3.50 | -4.95*** | 117 | -.724 |
| Master's Degrees | 52.75 | 15.06 | 100 | 66.47 | 12.78 | 99 | -17.63 | -9.82 | -6.93*** | 197 | -.983 |
| Regularly Certified Teachers | 95.44 | 7.25 | 100 | 99.38 | 2.27 | 99 | -5.44 | -2.43 | -5.18*** | 118 | -.733 |

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.*** $p < .001$ (2-tailed).

Table 3

Results of Students of Color and Teacher Variables Independent Samples t-test

| Measure | Group | | | | | | 95% CI | | <i>t</i> | <i>df</i> | Cohen's <i>d</i> |
|------------------------------------|----------|-----------|----------|----------|-----------|----------|-----------|-----------|----------|-----------|---------------------|
| | High SOC | | | Low SOC | | | | | | | |
| | <i>M</i> | <i>SD</i> | <i>n</i> | <i>M</i> | <i>SD</i> | <i>n</i> | <i>LL</i> | <i>UL</i> | | | |
| Highly Qualified Teachers | 92.45 | 11.34 | 100 | 98.96 | 2.56 | 99 | -8.82 | -4.21 | -5.61* | 109 | -.793 |
| Master's Degrees | 52.91 | 14.03 | 100 | 66.31 | 14.08 | 99 | -17.32 | -9.46 | -6.72* | 197 | -.953 |
| Regularly Certified Teachers | 95.50 | 7.27 | 100 | 99.32 | 2.31 | 99 | -5.32 | -2.30 | -5.00* | 119 | -.707 |

Note. SOC = students of color; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.*** $p < .001$ (2-tailed).

A similar relationship was found between percentage of highly qualified teachers and students of color. Again, as demonstrated in Table 3, significantly fewer highly qualified teachers are located in schools with higher levels of students of color. Comparisons of both student demographic variables with the percentage of teachers holding master's degrees were also statistically significant. The difference in percentage of teachers with a master's degree was nearly 14% for FRL and over 13% for students of color. The difference was large according to Cohen's *d*, demonstrating that there is a significant relationship between the percentage of teachers possessing a master's degree and the schools in which they locate. Last, significantly fewer regularly certified teachers were located in schools with higher levels of students eligible for FRL and students of color. Cohen's *d* indicates that the difference between schools is moderate to large. Overall, statistical analysis revealed that teachers with lower qualifications continue to locate in schools with higher levels of FRL and students of color.

Intricacies of the relationships between teacher qualifications and the schools in which they locate were further examined in the ArcMap program. Findings in GIS suggest that a geospatial relationship between student types and teacher qualifications exist. Figure 1 shows the percentage of students eligible for FRL are grouped in schools within the city (number 20) and school districts to the north (see *Appendix* for a full listing of school districts by number). Figure 2 shows that many of these school districts are comprised of schools that have the largest percentage of students of color. While the connection between student demographics is not a new finding, the patterns of corresponding teacher qualification data is potentially informative for future policy initiatives.

Schools with higher percentages of teachers that are not highly qualified are indicated by the larger dots, while schools that had 100% qualified teachers are denoted with the smallest dots. Figure 1 demonstrates that schools with higher levels of students eligible for FRL also had schools with higher percentages of teachers that were not highly qualified. The same pattern is observed in schools with higher levels of students of color (Figure 2). Further, the relationship between the location of schools with high levels of highly qualified teachers and the student variables was statistically significant ($r = -2.613, p < .01$). Thus, higher levels of highly qualified teachers are clustered in schools with lower levels of concentrated poverty and students of color.

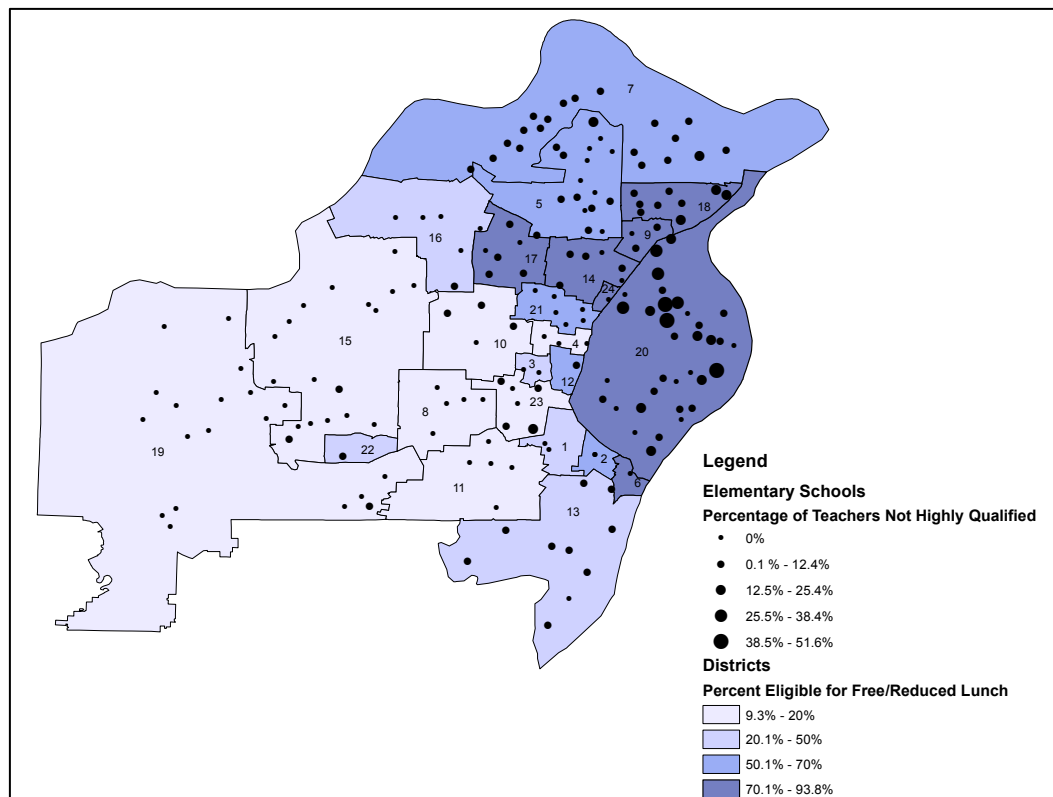


Figure 1. Location of highly qualified teachers by FRL

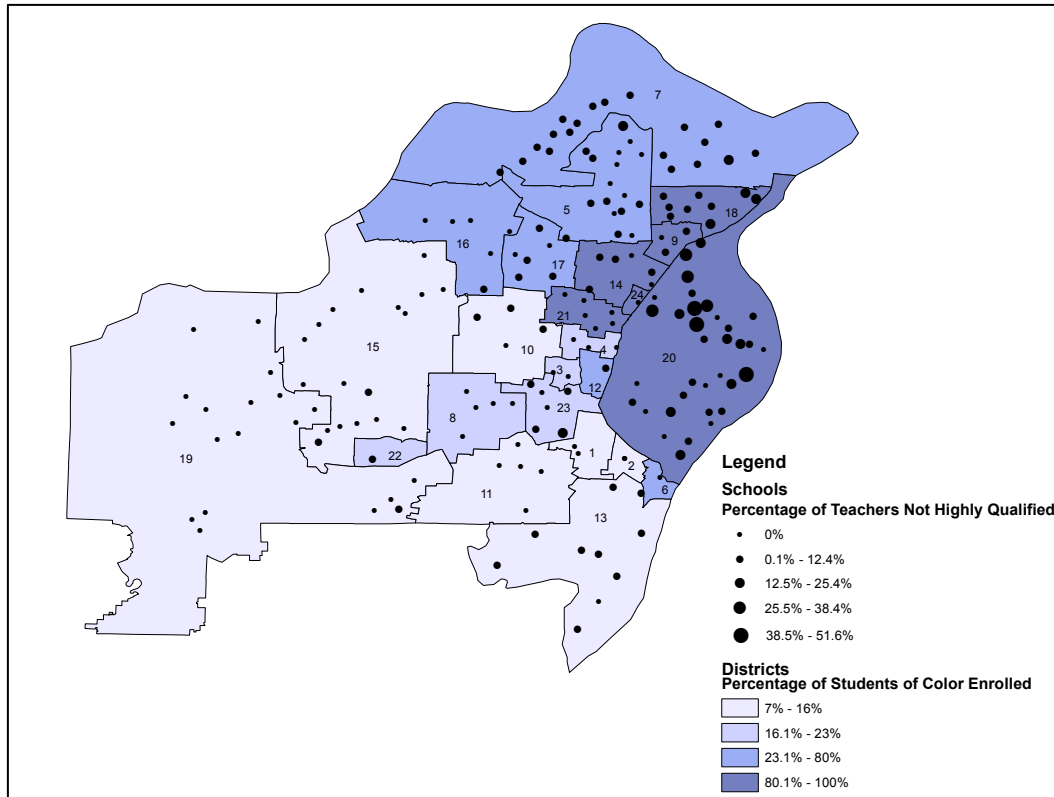


Figure 2. Location of highly qualified teachers by students of color

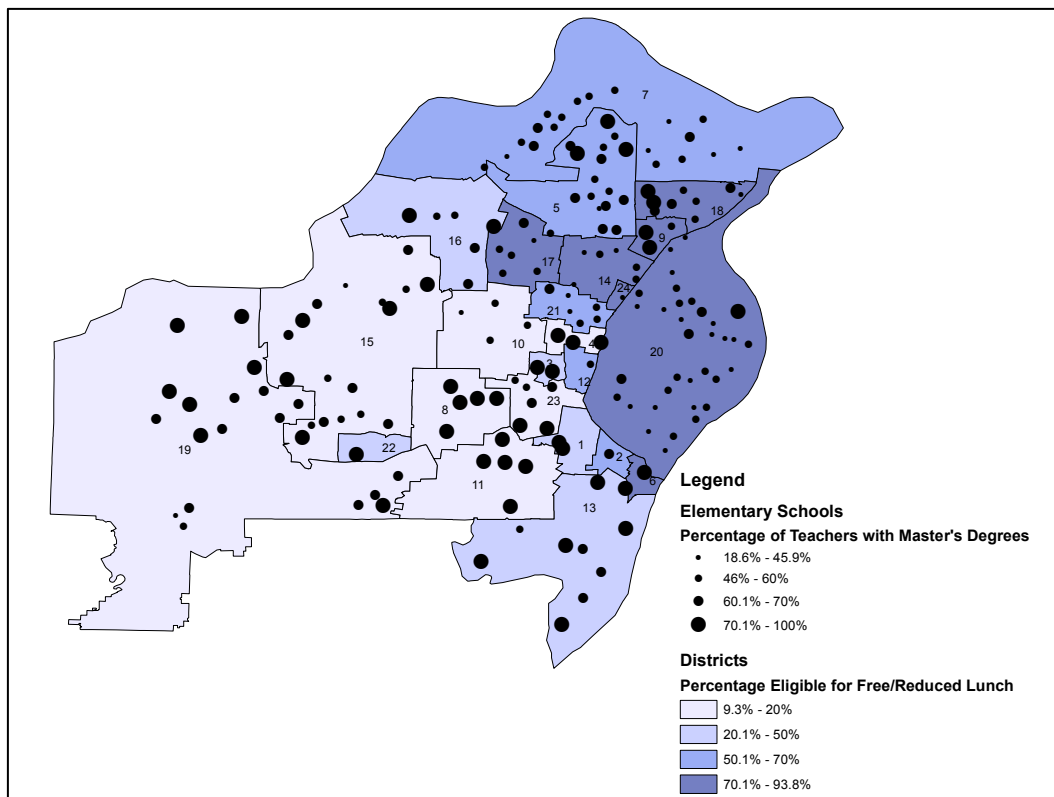


Figure 3. Location of teachers with master's degrees by FRL

Similar patterns were found for the location of higher levels of teachers with master's degrees (Figure 3) and higher levels of regularly certified teachers (Figure 4). Figure 3 shows that significantly lower levels of teachers with master's degrees are located within the city and northern suburbs, as represented by the smaller dots ($\bar{z} = -3.18, p < .01$). This clustering is important to note because teachers with master's degrees presumably have higher levels of specialized knowledge and are required to be paid more. Figure 3 clearly shows that schools with lower levels of poverty are the ones that currently employ higher percentages of such teachers. Implications of this finding will be discussed later. Additionally, the location of lower levels of regularly certified teachers (Figure 4) appeared to have some concentration within SLPS and the northern school districts. Nearest neighbor analysis revealed that this grouping was not statistically significant, however.

Lastly, although the clustering of regularly certified teachers was not statistically significant in GIS, an in-depth investigation into the information regarding teacher certification from 2009 yielded some troubling results. According to 2009 data sent to the Missouri School Improvement Plan, over 700 SLPS staff members had inappropriate certification, and over 60 had either expired or no certification at all (Adams, 2009). While approximately 25% of SLPS elementary schools listed all of their classroom teachers as regularly certified ($n = 10$), most did not ($n = 33$). One elementary school had a teaching staff composed of 20% Temporary/Special Assignment certified classroom teachers (median across schools with non-regularly certified teachers = 4.5%). The same elementary school also had 13% Substitute, expired, or non-certified teachers. Thus, one-third of its entire teaching staff was improperly certified in 2009¹¹.

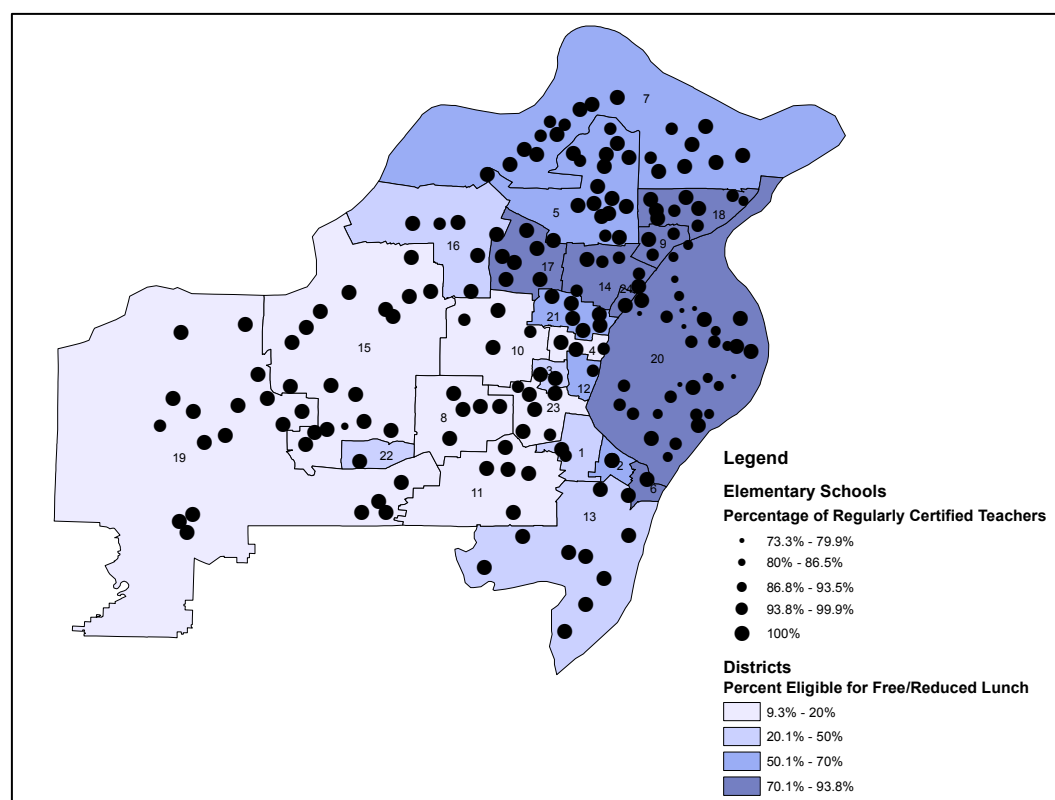


Figure 4. Location of regularly certified teachers by FRL

¹¹ The median for schools with Substitute, expired, or non-certified classroom teachers on staff was 6.1%.

Additionally, teachers from the program Teach for America are counted as being highly qualified, despite a lack of full state certification. Currently, the St. Louis region has 150 such teachers, 97 of whom are placed within SLPS (Crouch, 2013). The remaining teachers were placed in other high-need and unaccredited districts, such as Riverview Gardens. Approximately one-third of the TFA teachers in SLPS are placed in elementary schools. Teachers such as those from programs like Teach for America could possibly mask the true number of teachers who are appropriately certified in elementary education. Finally, the number of full-time, long-term substitutes is not reported. Arguably, community members may not have an accurate picture of who is truly teaching their children.

Discussion

Overall, this study indicates that elementary schools with higher levels of poverty and students of color in metropolitan St. Louis continue to struggle to meet the demands of an equitable teacher force, despite NCLB requirements. Results are consistent when both the NCLB definition and additional teacher qualifications are used. Both statistical analysis and GIS revealed higher percentages of highly qualified teachers and higher percentages of teachers with master's degrees are clustered in schools with lower levels of concentrated poverty and students of color. Last, even though statistical analysis demonstrated a significant negative relationship between FRL/students of color and the location of regularly certified teachers, this finding was not replicated in GIS. Although the purpose of NCLB's highly qualified teacher mandate was to create a higher-quality teaching force and to ensure equitable learning opportunities for all students, this analysis demonstrates that schools with higher levels of FRL and students of color are continuing to fail to meet NCLB's demand. Given that research has shown student SES significantly impacts the cognitive growth of young children, students from lower SES backgrounds need to have a highly qualified teacher from the beginning of their school experience (Burkham et al., 2004; Noble et al., 2005). Policy makers should enforce the NCLB mandate, as failing to provide equitable levels of highly qualified teachers to children in schools with higher levels of FRL in St. Louis may be negatively impacting the cognitive growth of students in these schools.

Despite not fully understanding the exact components that make a teacher effective, scholars agree that having students taught by a highly qualified teacher is vitally important, particularly at the elementary level, as elementary children typically spend the majority of their school day with one classroom teacher (Choi, 2010; Konstantopolous, 2011; Phillips, 2010; Rice, 2003). Although data regarding the percentage of highly qualified teachers is reported to DESE annually, it is unclear if there are any repercussions for the schools that do not meet this NCLB requirement. Further, Missouri is in the process of implementing its new teacher evaluation system, which allows them to bypass the 100% highly qualified teacher mandate under the new flexibility waiver (MODESE, 2012a). The implications of utilizing the MEES are unknown. Further, the results of the MEES will not be made public. Policy makers should ensure that the results of the MEES are available to the public so that the public has an idea about the quality of instruction their children are receiving. Further, more research needs to be conducted in order to understand the qualifications that teachers are bringing with them to their classroom, and how those qualifications play a role in teacher effectiveness. Policy makers should make sure to integrate these results into teacher evaluation systems.

Although flexibility waivers allow administrators to forgo having highly qualified teachers in their elementary classrooms, findings from previous research regarding the teacher certification

process indicate that having a teacher with an elementary education degree is important. Both Croninger et al. (2007) and Guarino et al. (2006) found that going through the process of obtaining an elementary education degree and certification had a positive relationship with student achievement. In Missouri, only teachers with a bachelor's degree, a passing score on the elementary Praxis exam, and full state certification for elementary school are considered to be highly qualified in the elementary classroom. Although any bachelor's degree counts towards the highly qualified definition, administrators should consider hiring teachers with elementary-specific degrees, given their demonstrated importance. Additionally, if Missouri is going to continue to use the MEES, more research needs to be done to ensure that the elementary certification process is continuing to lead teachers to produce effective practices within the classroom.

Possessing a regular certificate is currently part of the highly qualified teacher requirement in Missouri. An in-depth analysis of the location of teachers with a regular certificate provided notable results. Although the clustering of such teachers was not found to be statistically significant in GIS, one can observe that there are several schools possessing higher percentages of improperly certified teachers, particularly within SLPS. Further, a review of SLPS's Missouri School Improvement Plan revealed that approximately 75% of elementary schools in the district employed teachers that did not possess a regular certificate in 2009. It is important to note that teachers on a provisional/temporary license and teachers participating in alternative teaching programs (such as Teach for America) were considered highly qualified by the state despite not meeting the minimum standard, and are not included in this number. Schools should be required to report the number of provisionally/temporarily certified teachers they employ, as this study implies that such teachers could be artificially inflating the number of employed highly qualified teachers. Further, although Boyd et al. (2008) found that teachers from alternative programs are effective, more study on the effect these teachers have in the elementary classroom is necessary. If teachers from alternative programs are effective, then efforts should be made to hire more. Regardless, administrators should be required to report the number of teachers from alternative programs that they employ so that more valid study can be done to examine the effectiveness of such teachers in the elementary classroom.

Last, the NCLB requirement should be viewed as a minimum, as Choi (2010) suggested. Although teachers with advanced degrees may not directly impact elementary student performance, access to teachers with advanced degrees is often viewed by the public as important, as it may speak directly to the politics at play in segregated environments (Baybeck & Jones, 2004; Croninger et al., 2007; Guarino, 2006; Rice, 2003). Specifically, lack of access to teachers with higher degrees may point toward the underlying added financial burden that such teachers pose to a school district. Financially strapped school districts with higher levels of students of color and FRL may not be able to afford teachers with advanced degrees. The current analysis revealed access to teachers with advanced degrees (master's degree) is not equal across the St. Louis metropolitan region. Teachers with master's degrees were significantly clustered in school districts with lower levels of students eligible for FRL, and with lower levels of students of color. Therefore, even if all schools in this study met the minimum NCLB requirement, access to what the public often view as "quality" teachers would still be uneven. This study demonstrates that students in schools with higher levels of FRL and students of color are continuing to be taught by less "knowledgeable" teachers than their wealthier counterparts. Further, there may be a collective school-level effect on achievement that is not captured by individual teacher master's degree qualifications (Croninger et al., 2007). The possibility of such effects needs to be further examined so that policy makers can make informed decisions about the importance of advanced degrees.

While many of these findings are important for policy makers, some limitations to the study exist. First, FRL serves as a proxy for poverty. Although this data can be useful in making

associations between student and teacher demographics, it is merely a rough estimation of district conditions. Further, variations in conditions across districts may exist, but were not analyzed in this study. Lastly, qualifications at the individual teacher level may have collective effects at the school level. Therefore, as Croninger et al. (2007) suggest, future studies should include a closer look at the impact of individual teacher qualifications on collective school effects in St. Louis. Such studies should be extended to the growing number St. Louis charter schools, and how teacher quality may impact school performance in charter school environments. Additionally, with the adoption of the MEES, new research needs to be done on the ability of this new evaluation system to accurately assess teacher effectiveness. Relatedly, more study needs to be done on what makes a teacher “effective,” and the ways in which “effectiveness” may be context-bound. Given the potential impact that effective teachers have on student achievement, particularly for students in schools with higher percentages of FRL and students of color, future studies should continue to closely examine variables related to teacher quality.

Conclusion

The findings from this study are relevant to current policy discussions, as teacher quality has been shown to be essential for elementary students. Having a highly qualified teacher in an elementary classroom is vitally important, as elementary children spend the majority of their day with their classroom teacher. An elementary teacher is typically responsible for teaching the majority of subject content so having a teacher who is effective helps ensure that students are receiving their content instruction from someone who is knowledgeable. This study uses both NCLB’s definition of a highly qualified teacher and additional measures of teacher quality to examine whether or not the geographic distribution of elementary teacher qualifications in the St. Louis metropolitan area is equitable. Despite NCLB’s requirement that all schools employ highly qualified teachers, distribution in St. Louis is still inequitable among areas with higher levels of students of color and students living in poverty. Students in these areas have significantly lower levels of highly qualified teachers, regularly certified teachers, and teachers with advanced degrees. These findings reflect previous research that has found students with lower SES backgrounds have a higher percentage of less qualified teachers, in spite of NCLB’s attempt to remedy this.

Even more disturbing, a review of the Missouri School Improvement Plan submitted by the St. Louis Public School District in 2009 revealed that 75% of elementary schools in the district employed teachers with improper certification and did not meet the requirements set forth by NCLB. Further, exceptions to the NCLB definition of highly qualified continue to be made without being reported as such. Exceptions such as uncertified teachers from Teach for America may be masking the true number of highly qualified teachers present in the classroom. This study found that a large proportion of teachers falling under exceptions are located within areas of higher levels of students of color and FRL. Such a finding is troubling, as these schools already have lower levels of highly qualified teachers. By employing teachers that are the exception to the definition, schools in these areas may be artificially inflating their numbers of highly qualified teachers. Schools need to report the number of provisionally/temporarily certified teachers they employ, particularly those that fall underneath the exception for alternative teaching programs, so that the general public has a more accurate picture of who is teaching our students.

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Appendix

School Districts by Number on Maps

- 1). Affton
- 2). Bayless
- 3). Brentwood
- 4). Clayton
- 5). Ferguson-Florissant
- 6). Hancock Place
- 7). Hazelwood
- 8). Kirkwood
- 9). Jennings
- 10). Ladue
- 11). Lindbergh
- 12). Maplewood-Richmond Heights
- 13). Mehlville
- 14). Normandy
- 15). Parkway
- 16). Pattonville
- 17). Ritenour
- 18). Riverview Gardens
- 19). Rockwood
- 20). City of Saint Louis
- 21). University City
- 22). Valley Park
- 23). Webster Groves
- 24). Wellston

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